



Rome Cardiology Forum

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Update on
stable coronary artery disease
Risk stratification

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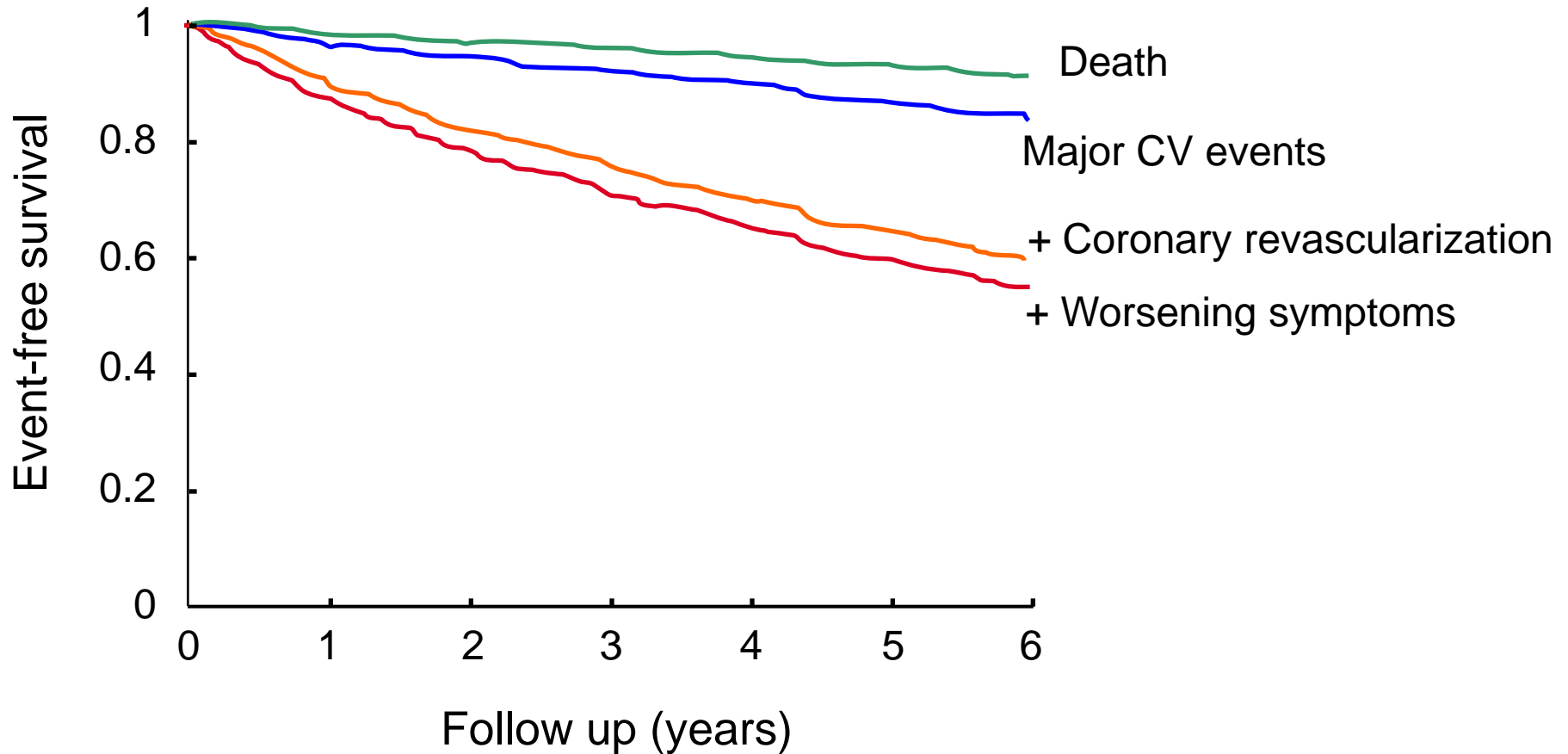
Which end-point ?

- All-cause mortality
- Cardiovascular mortality
- Cardiac mortality
- Sudden death
- Acute myocardial infarction
- Acute coronary syndromes
- Coronary revascularization
- Hospitalization
- Symptoms / Quality of life

Which end-point ?

- All cause mortality
- Cardiac mortality
- Acute myocardial infarction

Event-free survival curves of 2170 patients with angina



Patients with stable CAD

- Patients with stable angina episodes
- Asymptomatic patients with documented or suspected CAD
- *De novo* effort angina / low risk unstable angina
- Previous MI
- Previous interventions (PCI CABG)
- Specific subgroups
 - Microvascular angina
 - Vasospastic angina
 - Refractory angina

2013 ESC guidelines on the management of stable coronary artery disease

The Task Force on the management of stable coronary artery disease of the European Society of Cardiology

Task Force Members: Gilles Montalescot* (Chairperson) (France), Udo Sechtem* (Chairperson) (Germany), Stephan Achenbach (Germany), Felicita Andreotti (Italy), Chris Arden (UK), Andrzej Budaj (Poland), Raffaele Bugiardini (Italy), Filippo Crea (Italy), Thomas Cuisset (France), Carlo Di Mario (UK), J. Rafael Ferreira (Portugal), Bernard J. Gersh (USA), Anselm K. Gitt (Germany), Jean-Sebastien Hulot (France), Nikolaus Marx (Germany), Lionel H. Opie (South Africa), Matthias Pfisterer (Switzerland), Eva Prescott (Denmark), Frank Ruschitzka (Switzerland), Manel Sabaté (Spain), Roxy Senior (UK), David Paul Taggart (UK), Ernst E. van der Wall (Netherlands), Christiaan J.M. Vrints (Belgium).

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION



2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons

Stephan D. Fihn, Julius M. Gardin, Jonathan Abrams, Kathleen Berra, James C. Blankenship, Apostolos P. Dallas, Pamela S. Douglas, JoAnne M. Foody, Thomas C. Gerber, Alan L. Hinderliter, Spencer B. King III, Paul D. Kligfield, Harlan M. Krumholz, Raymond Y.K. Kwong, Michael J. Lim, Jane A. Linderbaum, Michael J. Mack, Mark A. Munger, Richard L. Prager, Joseph F. Sabik, Leslee J. Shaw, Joanna D. Sikkema, Craig R. Smith, Jr, Sidney C. Smith, Jr, John A. Spertus and Sankey V. Williams

Cardiac risk classification

	Low risk	Intermediate risk	High risk
All-cause death	<1%	1-2 (1-3) %	>2 (3) %

Tools for risk stratification in stable CAD

- Clinical variables
- Laboratory variables
- ECG exercise stress test
- Cardiovascular imaging
 - Echocardiographic studies
 - Radionuclide studies
 - CMR studies
 - CT-coronary angiography
- Invasive studies

ESC guidelines 2013

	Class	LoE
Risk stratification based on clinical assessment and stress test initially employed for diagnosis of CAD	I	B
Exercise ECG as initial test when PTP of 15-65%	I	B
Stress imaging as initial test preferred if availability and local expertise permit when PTP 15-65%	I	B
Stress imaging as initial test if PTP 66-85% or LVEF <50% without typical angina	I	B
Coronary CT angiography as an alternative in patients with PTP 15-50%	IIa	C
Invasive angiography in severe angina or high risk profile	I	C

AHA/ACC guidelines 2012

	Class	LoE
Exercise ECG	I	B
Exercise stress imaging uninterpretable ECG	I	B
interpretable ECG	IIa	B
Pharmacological stress CMR	IIa	B
CT-CA (uninterpretable ECG)	IIb	B
Invasive angiography		
Cardiac arrest/severe arrhythm	I	B
Development of HF	I	B
High risk on noninvasive tests	I	C

ECG exercise stress test

Prognostic variables on ECG exercise stress test

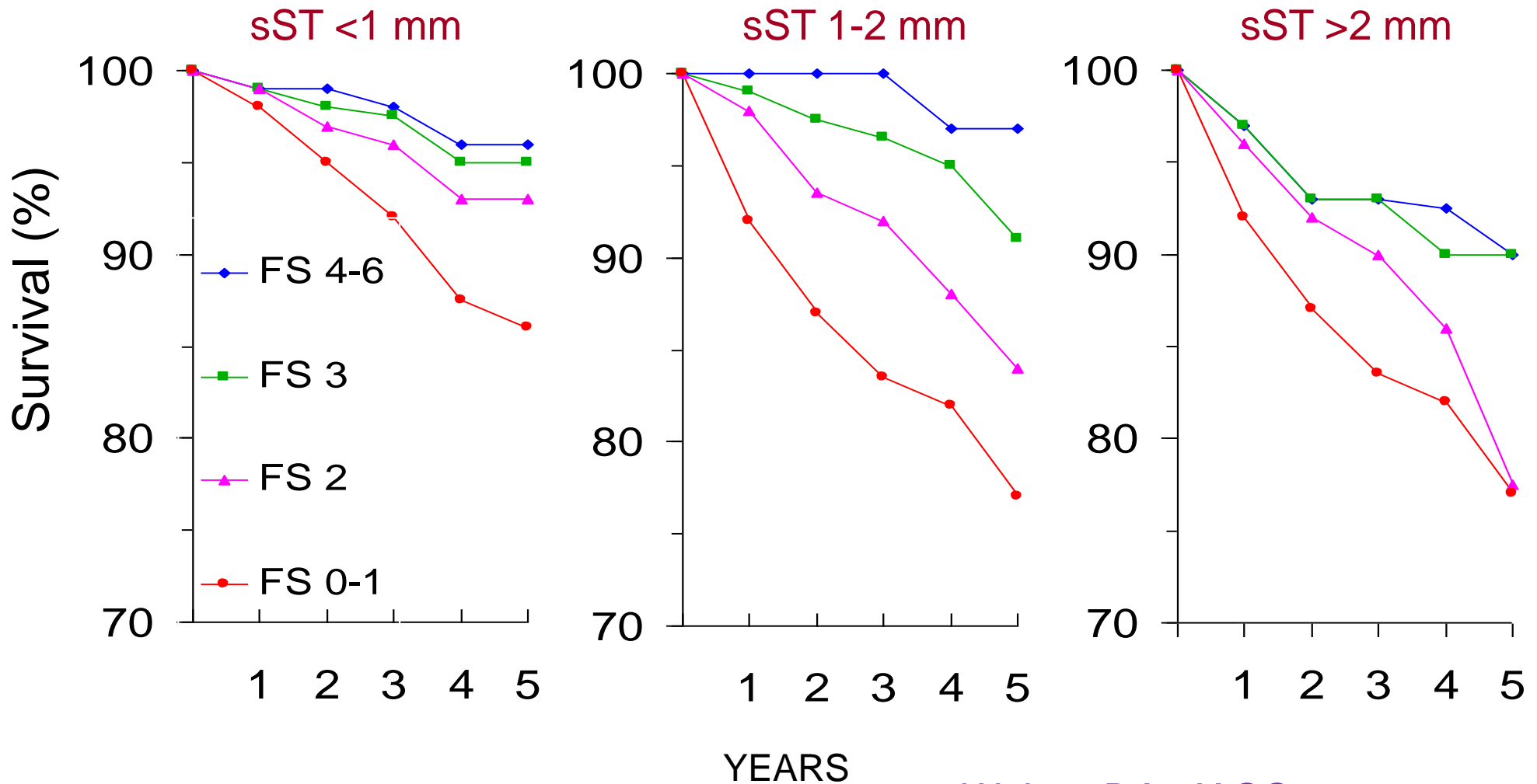
Ischemic variables

- ST-segment changes
- Time, RPP, METs at 1 mm ST
- Type, severity, extension and duration of ST changes
- Slope (index) ST/HR; ST recovery loop
- Angina (assessment as for ST-segment changes)

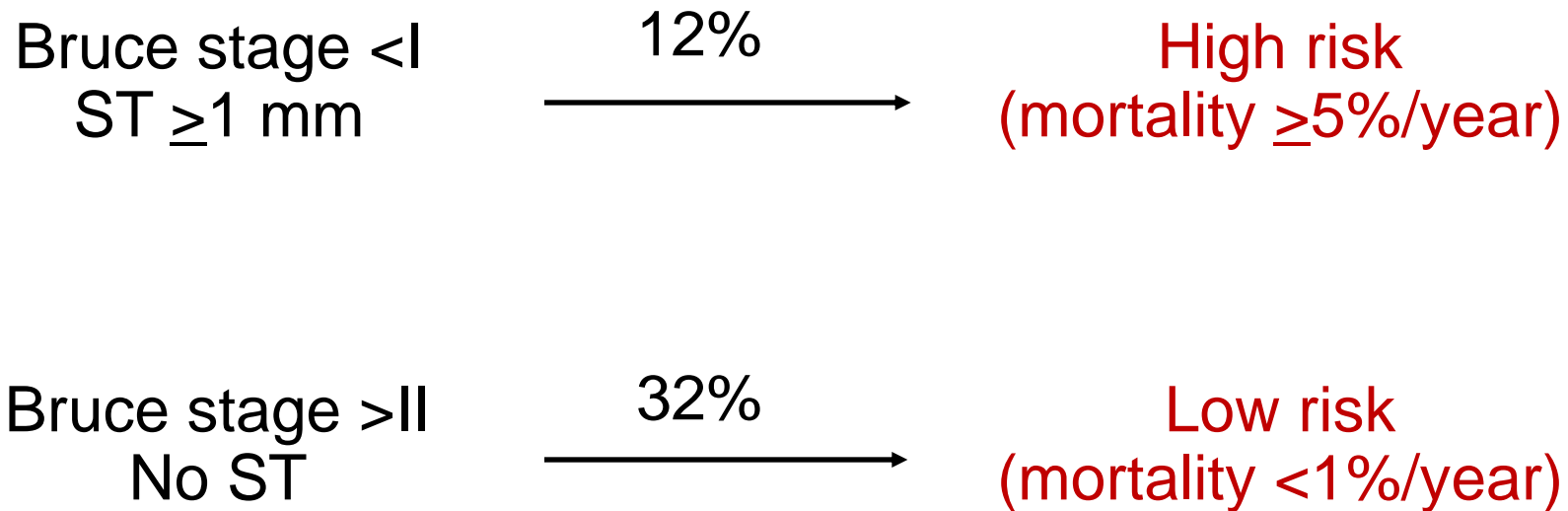
Hemodynamic variables

- Exercise duration, METs
- HR, BP, RPP achieved during the test
- BP behavior
- HR recovery

Exercise capacity, ST changes and survival in CASS registry (n=4,083)



CASS registry



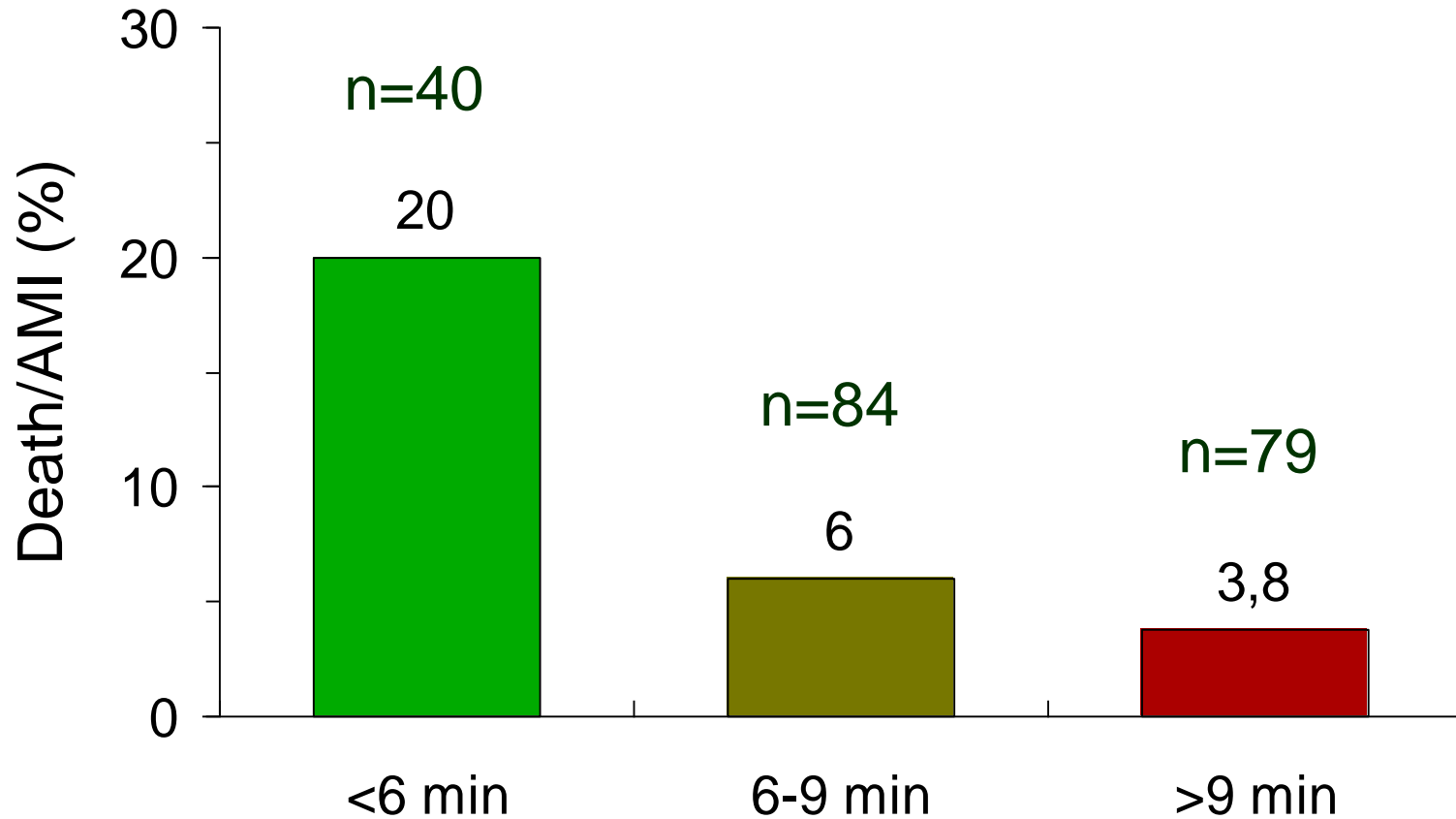
Exercise variables and prognosis (1969-1985)

	CASS	Duke	VA	CNR	Belga	Tedesco	SHW
No. patient	4083	2842	2546	1083	470	1238	337
Follow up (yrs.)	5	5	5	5.5	5	4.5	3
ST changes	+	+	+	+			
Angina	+	+				+	
Ex capacity	+	+	+	+	+	+	+
Systolic BP, max			+				+
Heart rate, max	+					+	+
Diastolic BP, max							+
Scores		+	+		+		

Independent predictors of death/AMI in 33.268 patients with suspect CAD

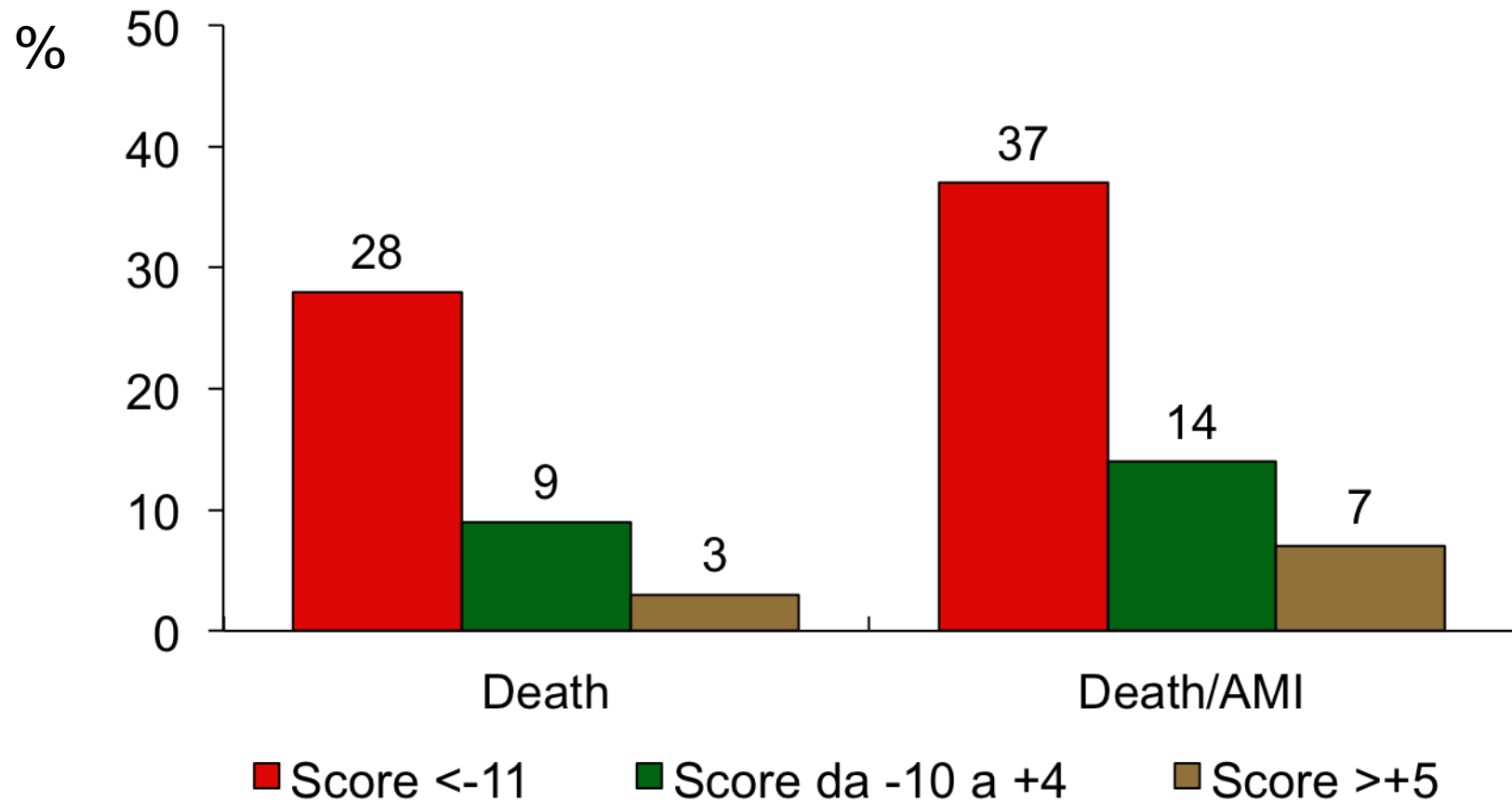
	Adjusted HR	95% CL	P value
Age (61 vs. 45)	4.04	3.53-4.62	<0.001
Sex (M vs. F)	1.83	0.37-0.83	<0.001
DM treated with insulin	1.85	1.50-2.28	<0.001
DM not treated with insulin	1.31	1.12-1.53	<0.001
Exercise capacity	0.53	0.49-0.58	<0.001
Reduced HR recovery	1.46	1.31-1.62	<0.001
ST-segment depression	0.77	0.50-1.20	0.23

Exercise duration and events in CAD patients with ST depression ≥ 2 mm (3.5-year follow-up)



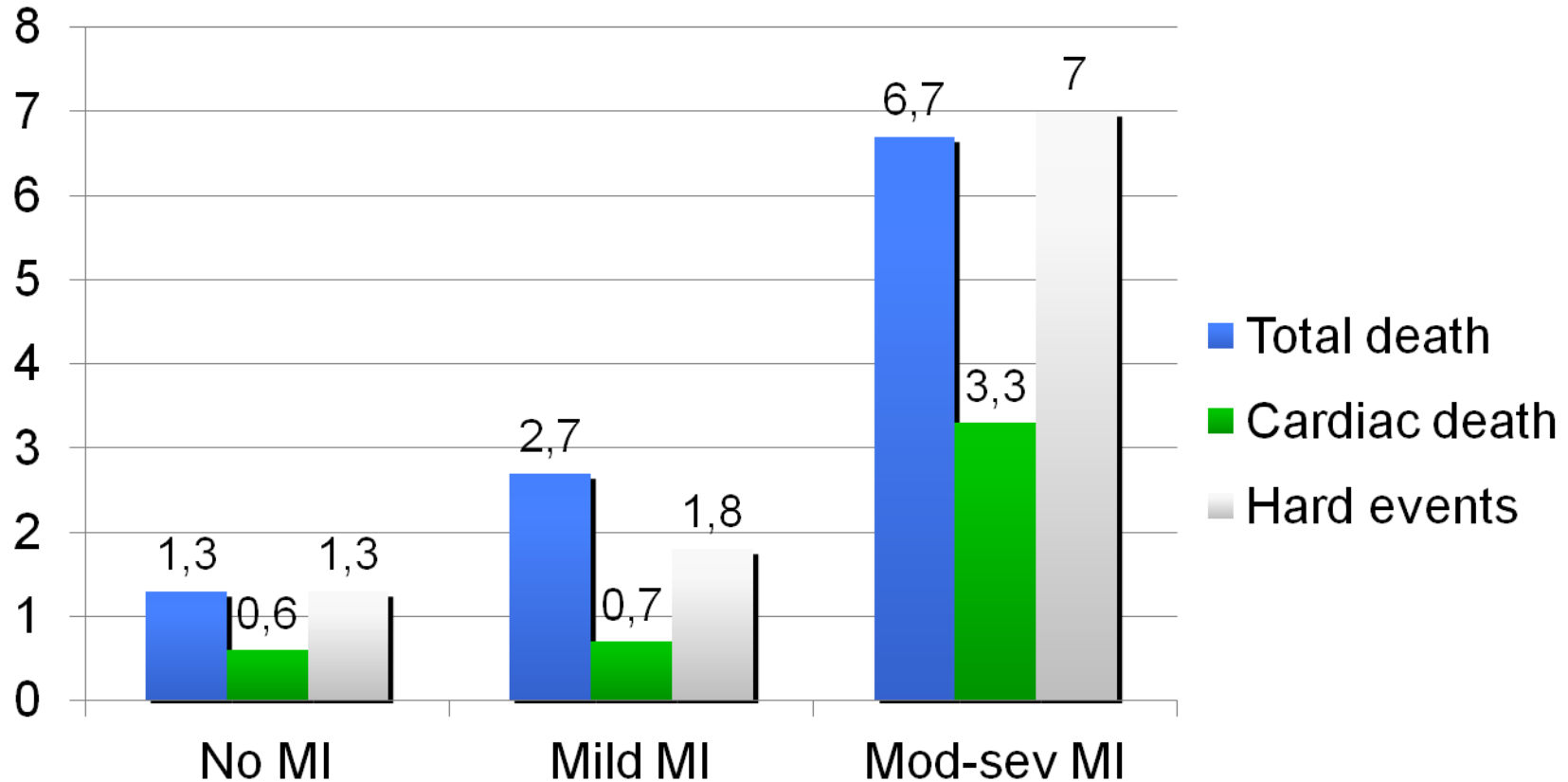
Treadmill score and 5-year clinical events

$$\text{Score} = (\text{Exercise time}) - (5 \times \text{sST}) - (4 \times \text{index angina})$$

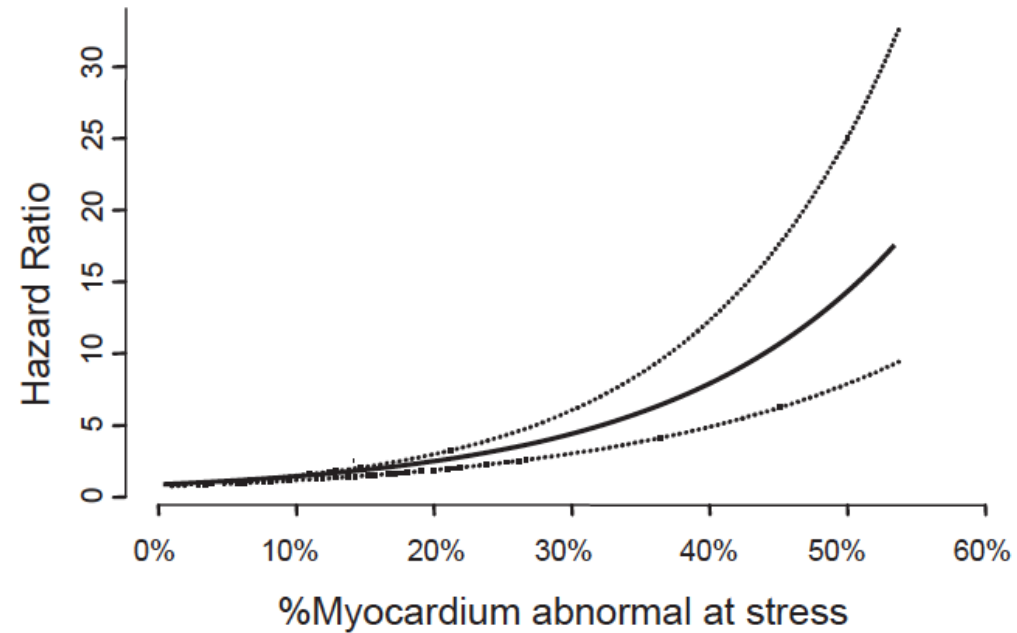
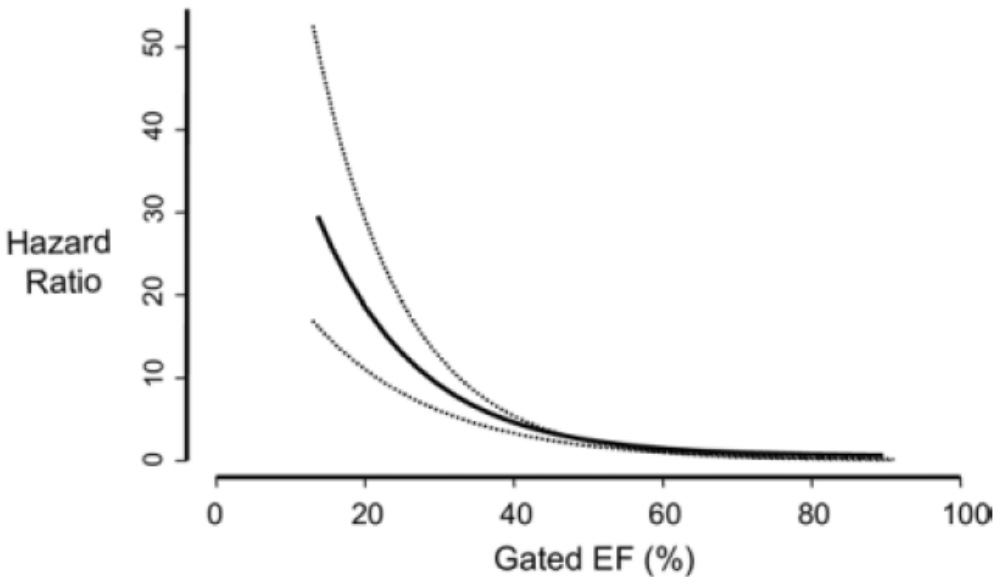


Imaging stress tests

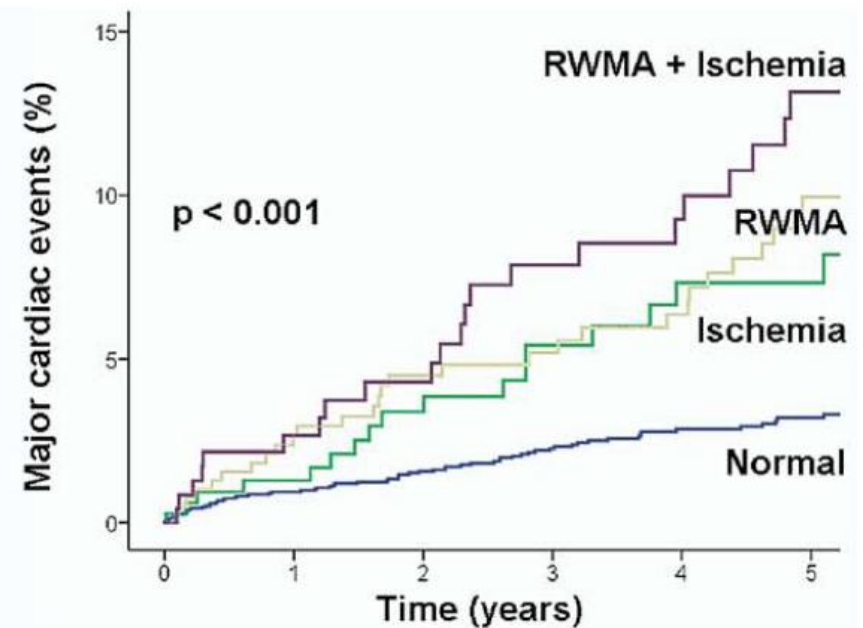
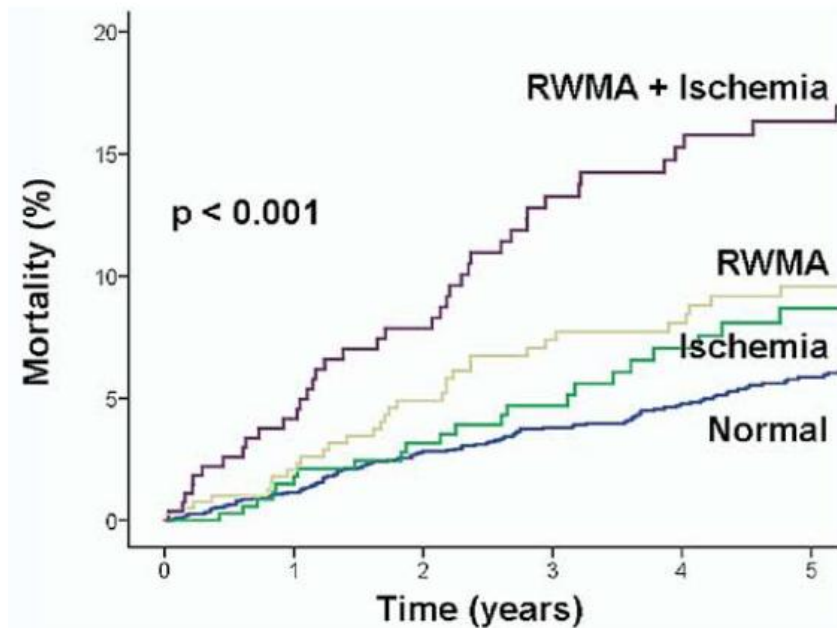
Severity of myocardial ischemia and clinical outcome



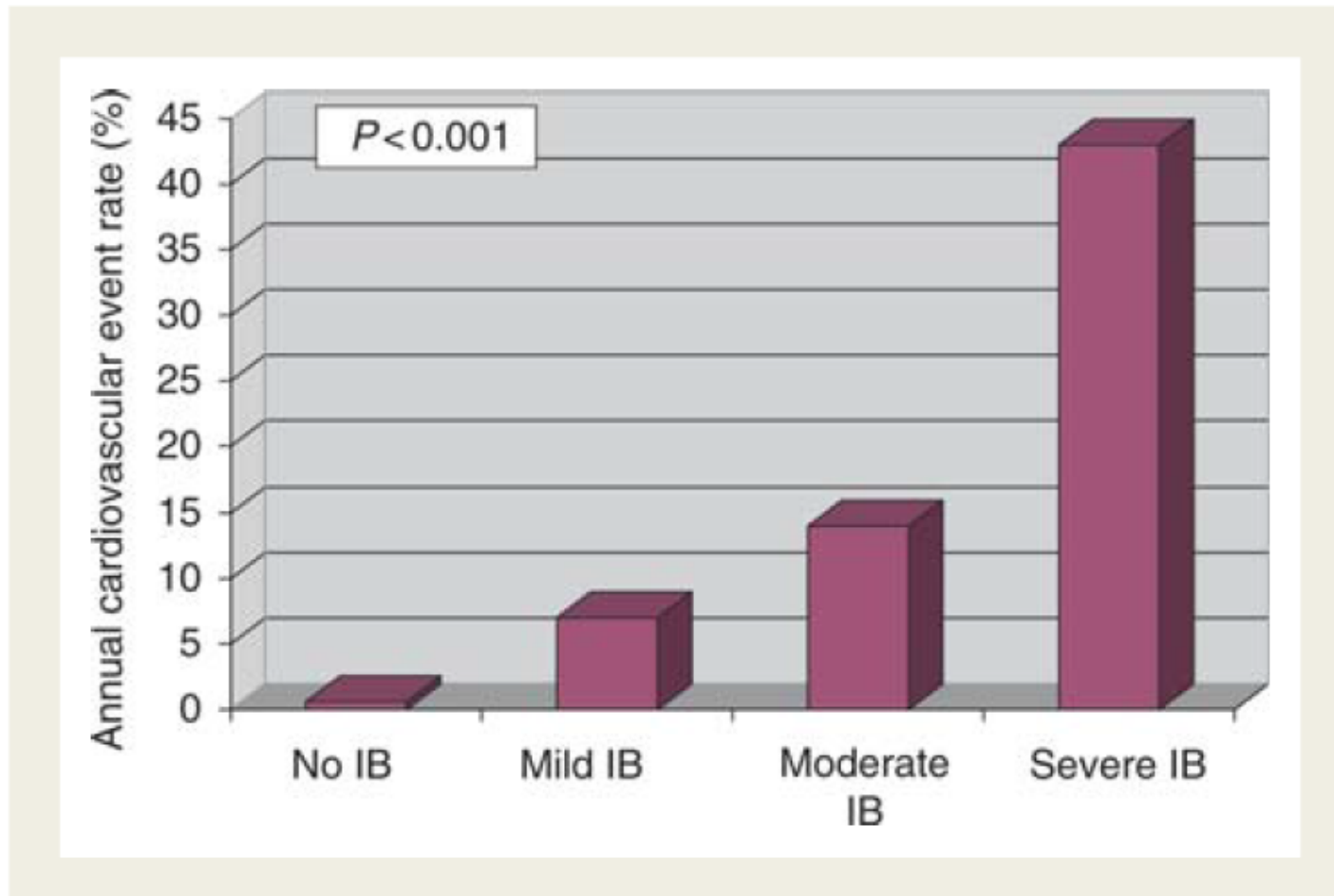
Risk of death according to LVEF and MI at myocardial scintigraphy



Clinical events according to MI and RWMA at exercise echocardiography

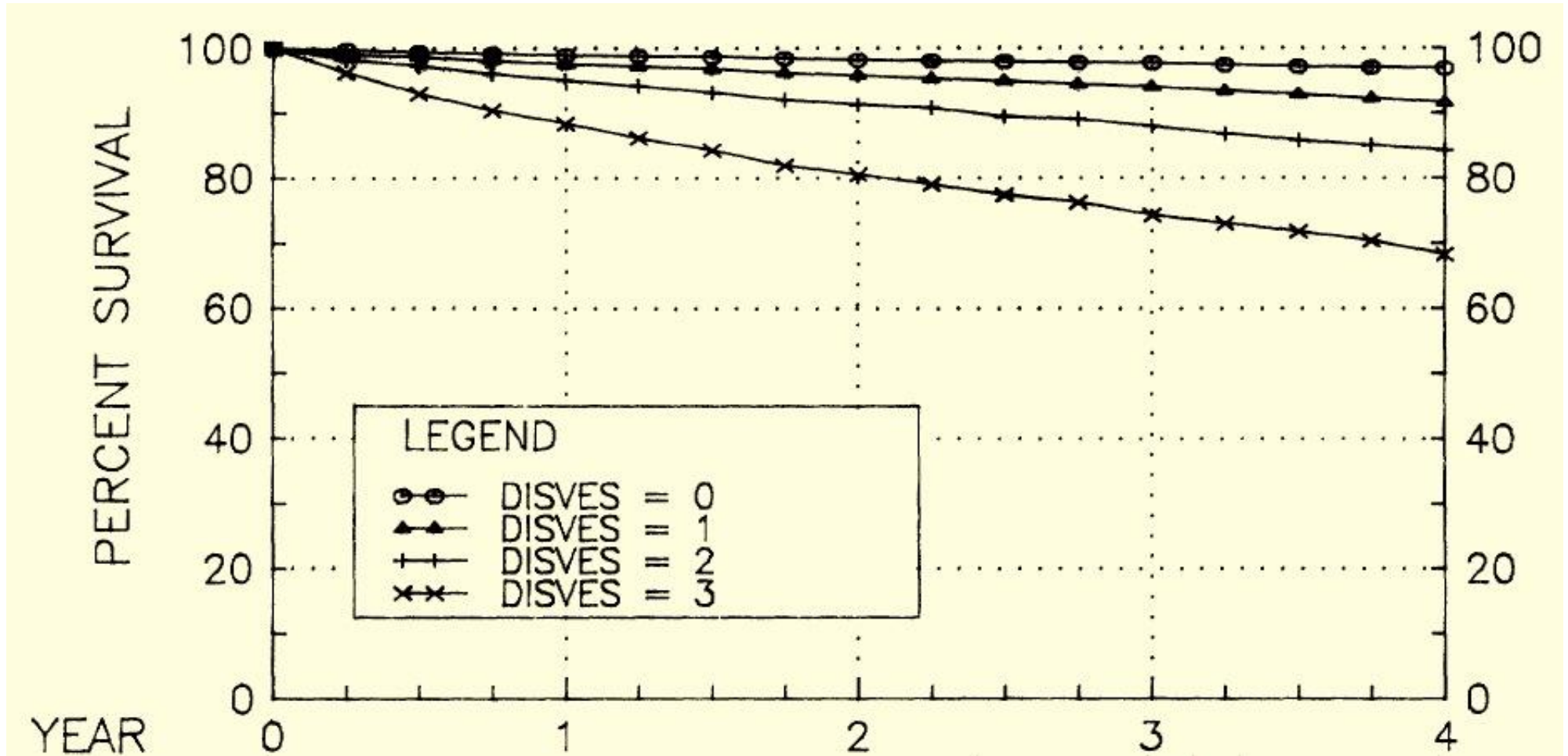


Annual CV events according to MI at stress echocardiography

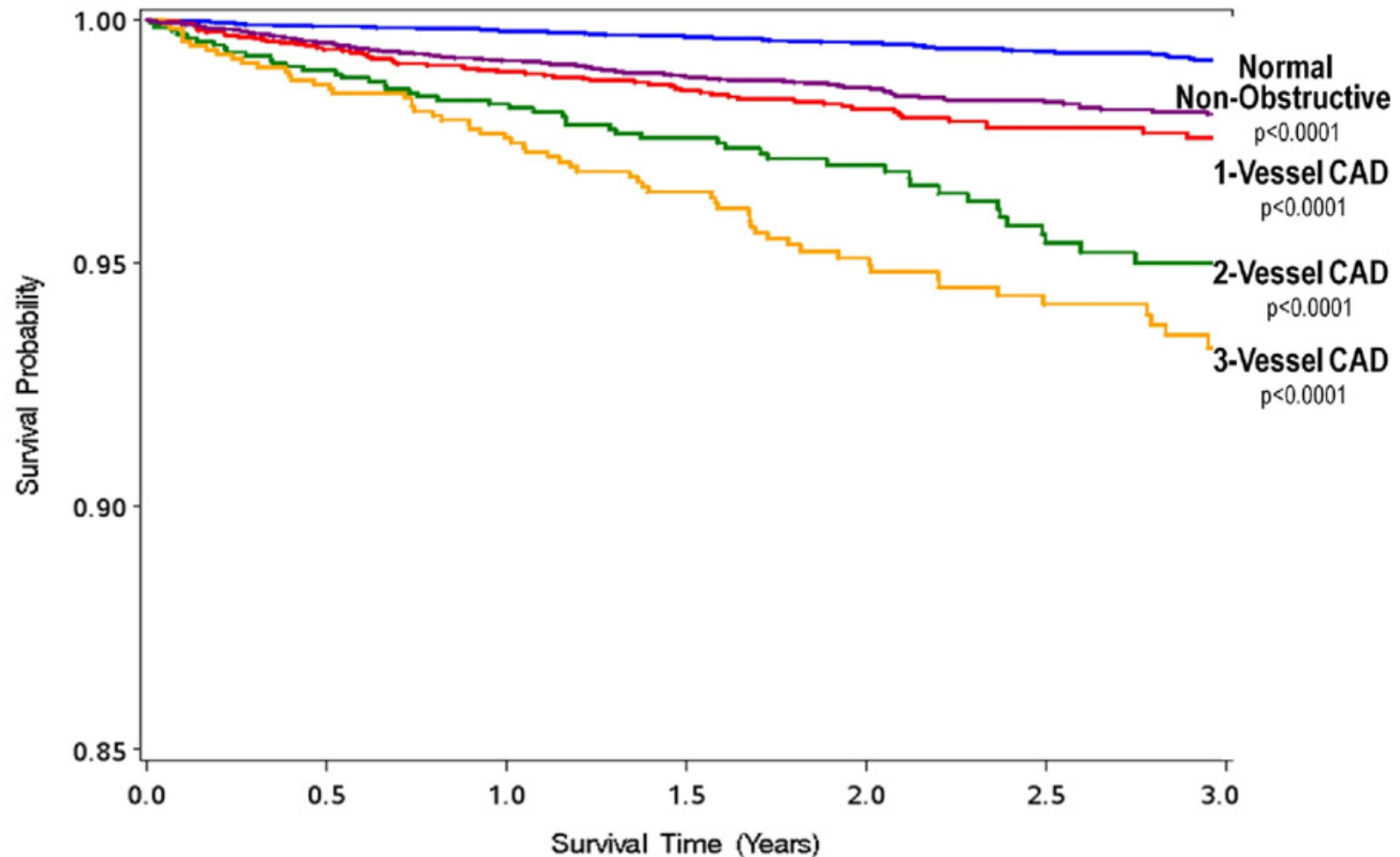


CT-scan, Angiography

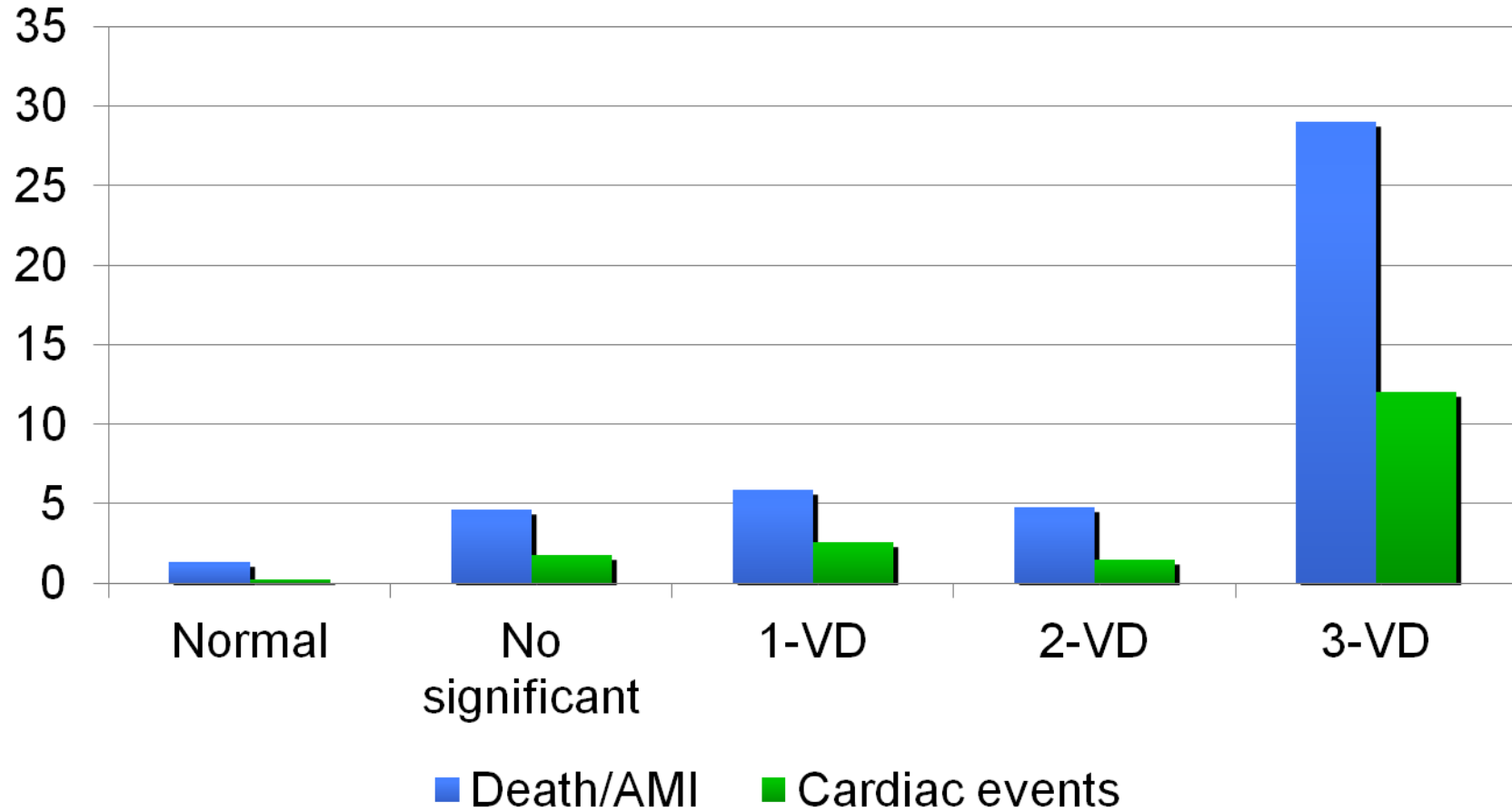
Survival in the CASS registry



Survival according to CAD detected at CT-angio (CONFIRM)



CT-angio results and prognosis



Reasons for ECG-EST preference as first test in stable CAD

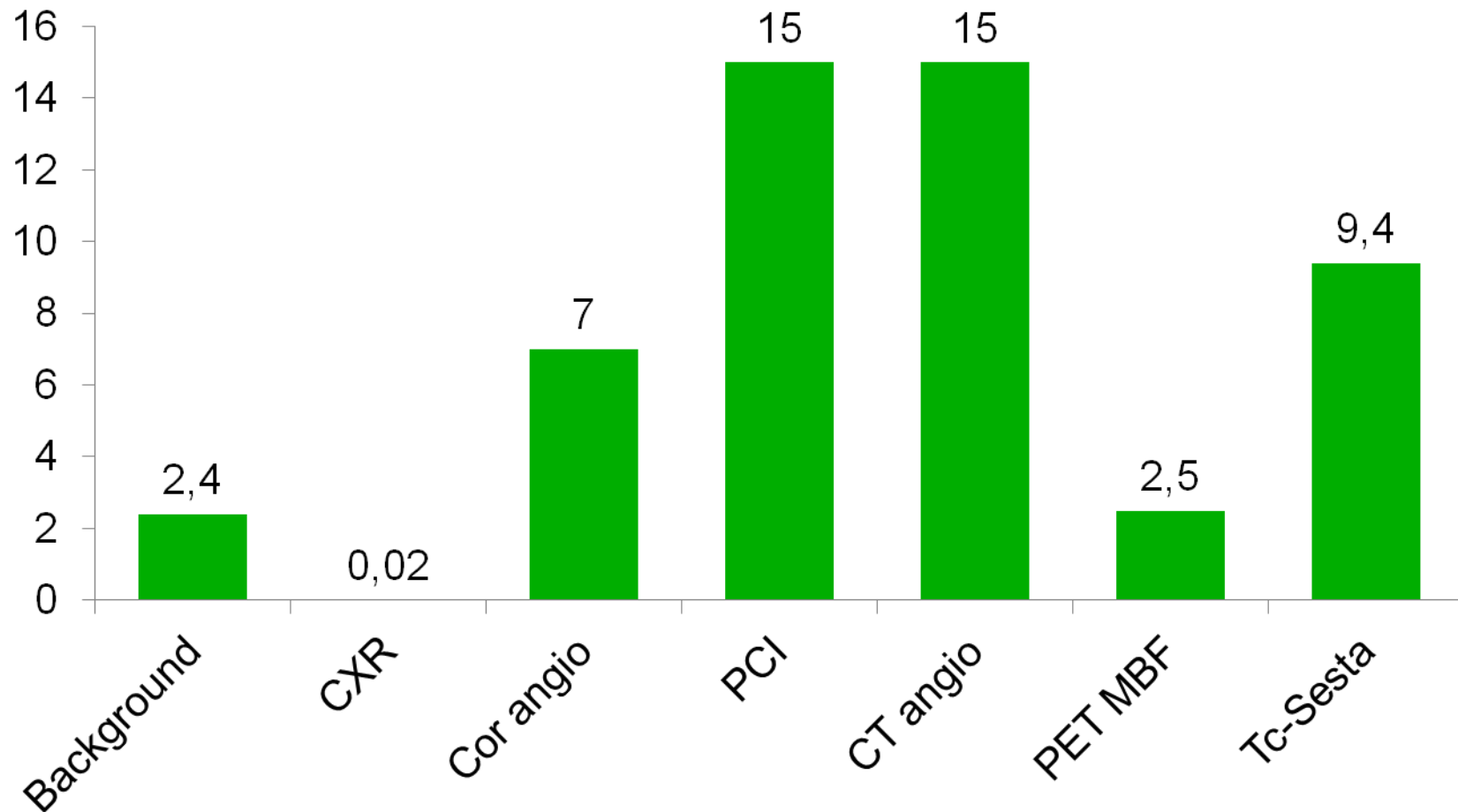
- Method

- Larger availability
- Easy repeatability to guide management and follow-up
- Low operator variability
- Detailed ischemic and functional assessment
- Low cost

- Studies

- Larger populations assessed
- Longer follow-up
- Lower referral bias
- Lower publication bias
- Assessed in prospective trial

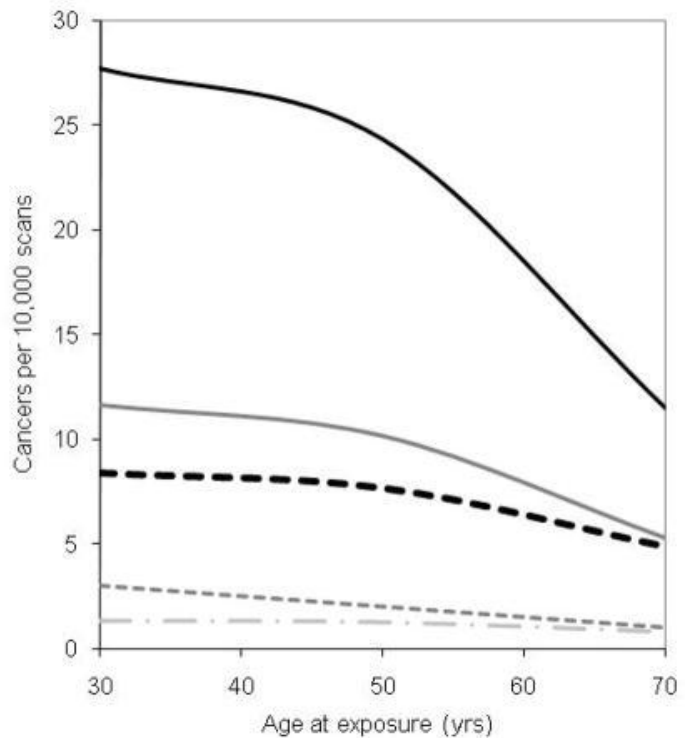
Average exposure to radiation (mSv) for some common cardiological examinations



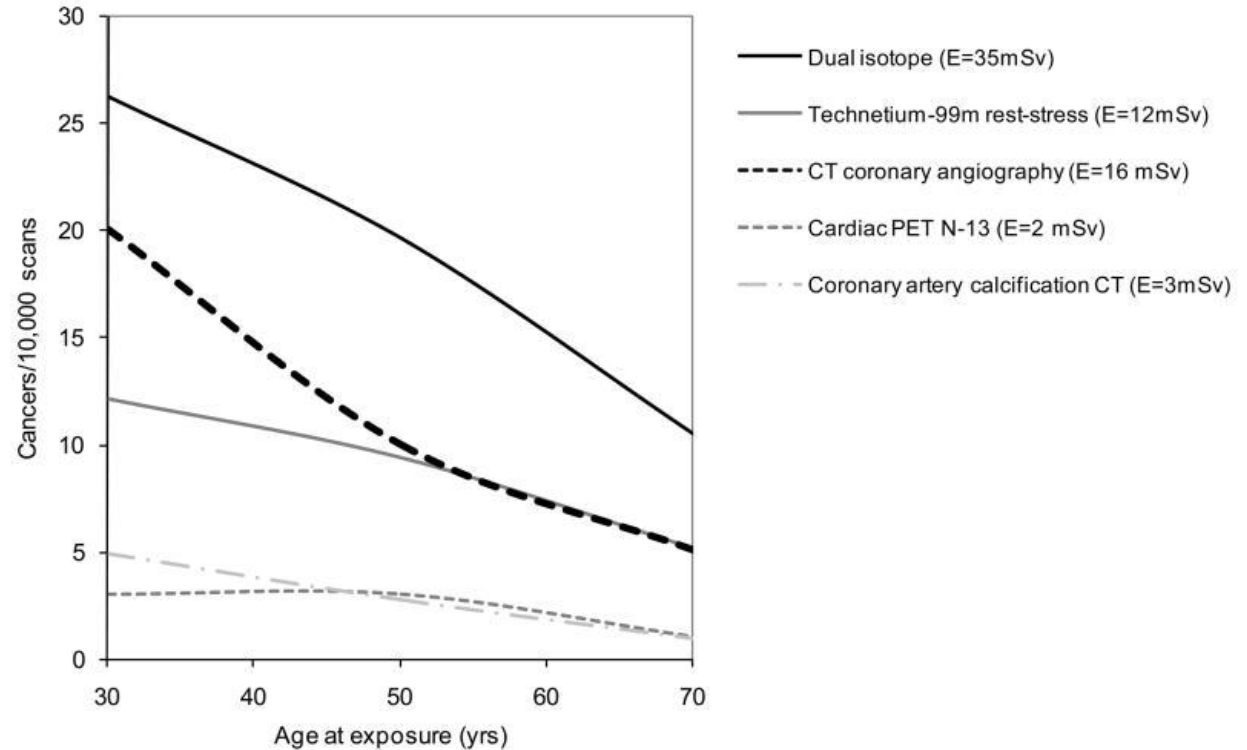
Data from: Picano E, Eur Heart J 2014, Jan 8

Estimated risk of cancer associated with Cardiac radiological diagnostic tests

Men

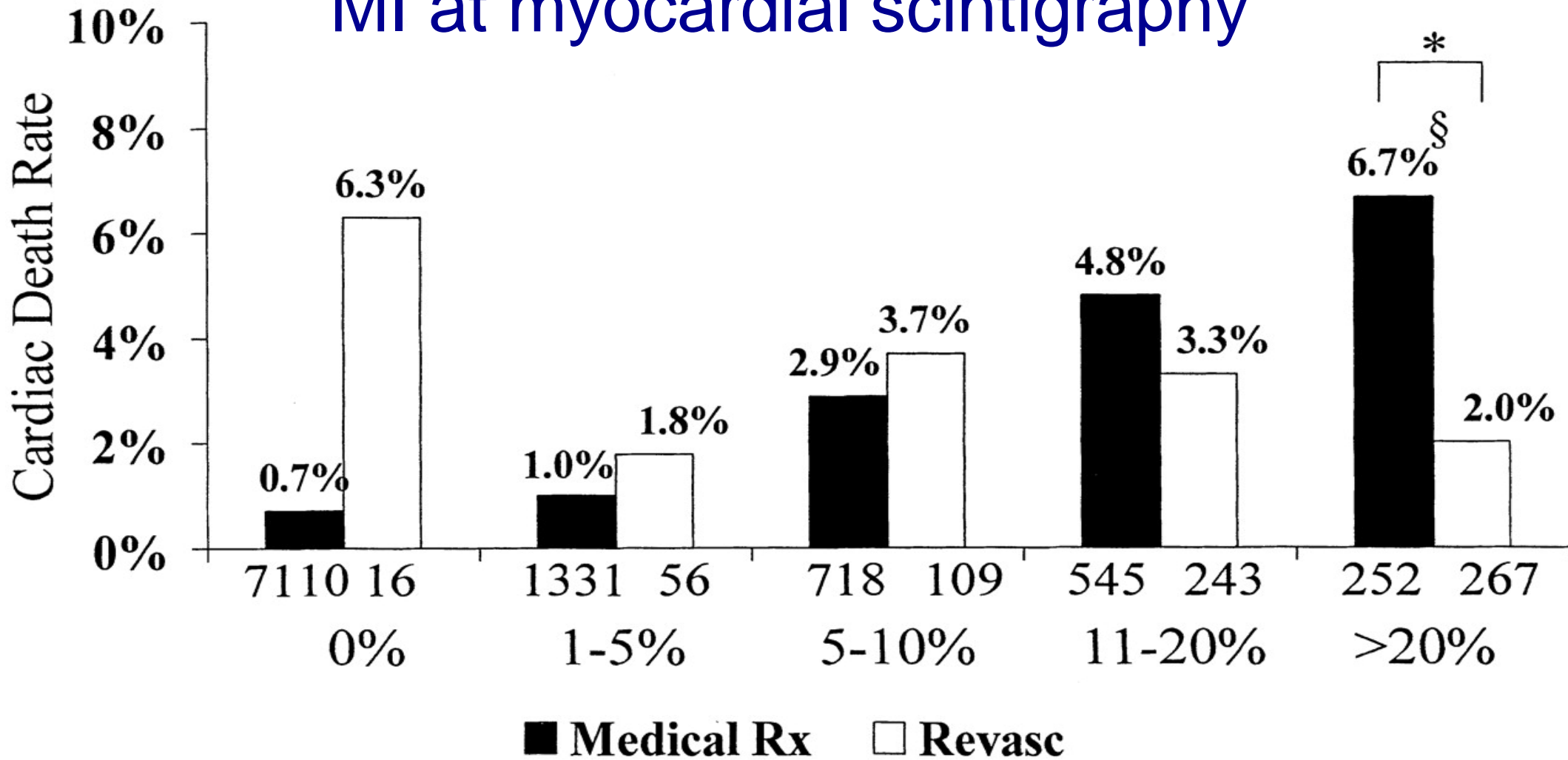


Women

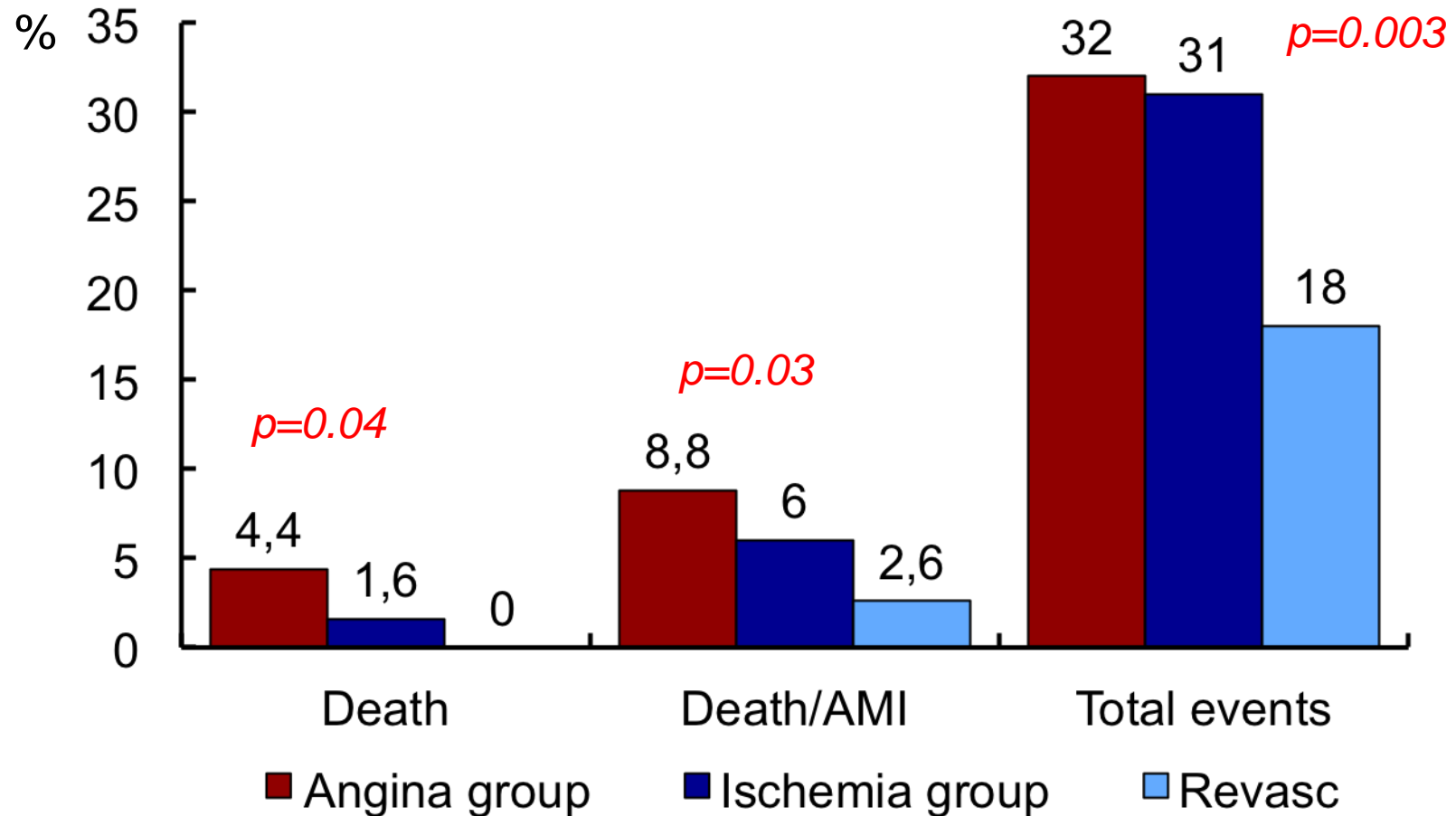


Does suppression of
myocardial ischemia
improve prognosis ?

Risk of death according to LVEF and MI at myocardial scintigraphy



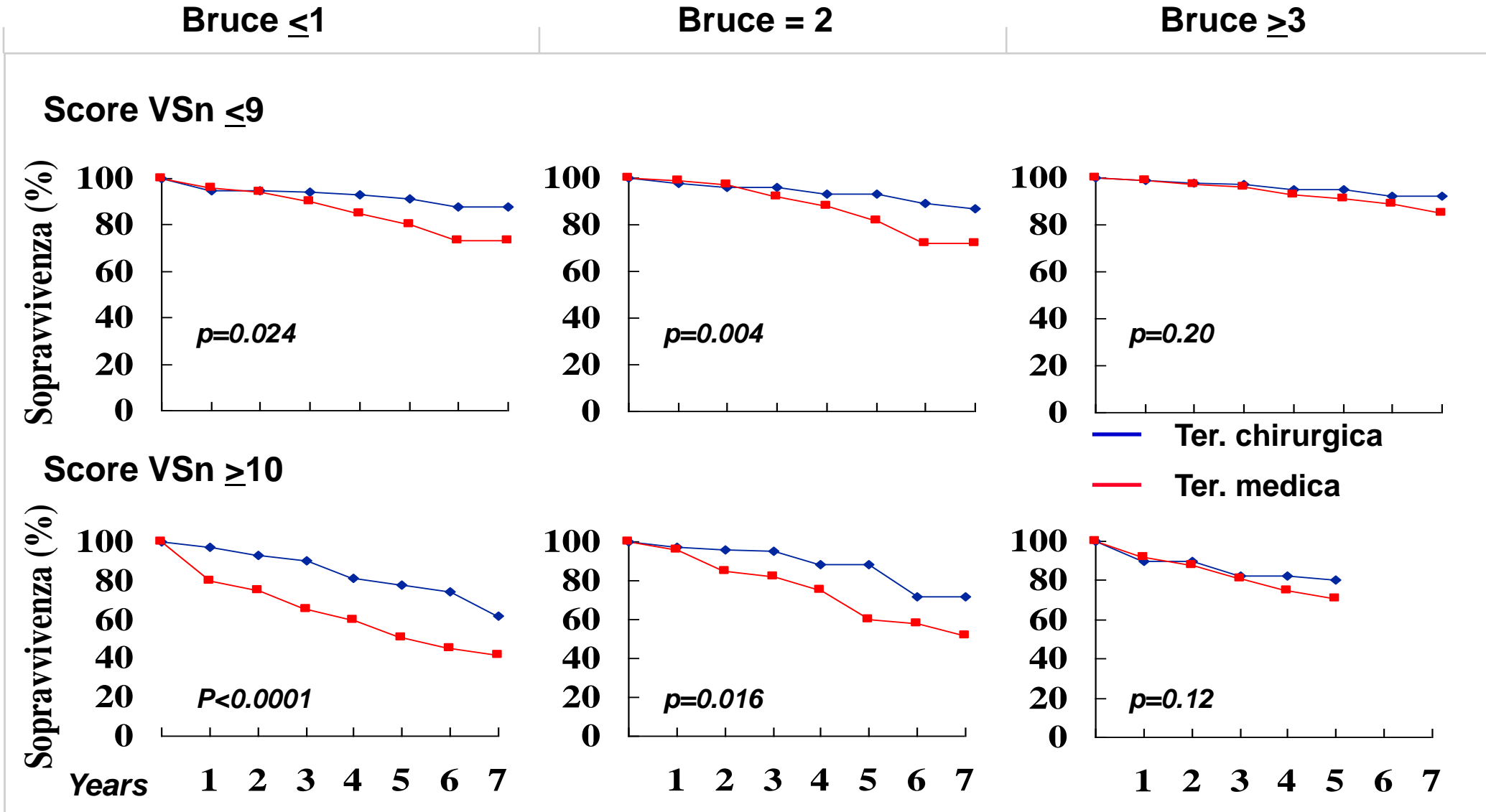
Asymptomatic Cardiac Ischemia Pilot Study (ACIP) – 1-year follow-up



CABG indications for survival improvement according to clinical trials

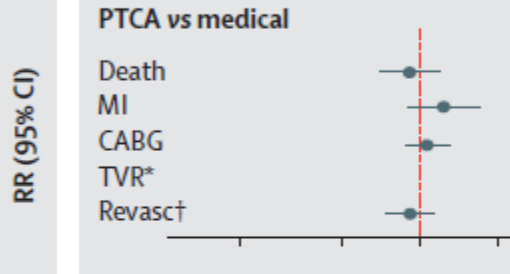
- Left main vessel disease (>50%)
- Three-vessel disease
 - ◆ Impaired left ventricular function
 - ◆ Reduced exercise tolerance
 - ◆ Life-threatening arrhythmias (?)
- Proximal LAD coronary artery stenosis (>70%) with 2V-disease

Survival in patients with 3-vessel disease in the CASS study

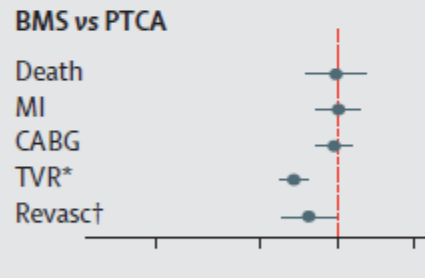
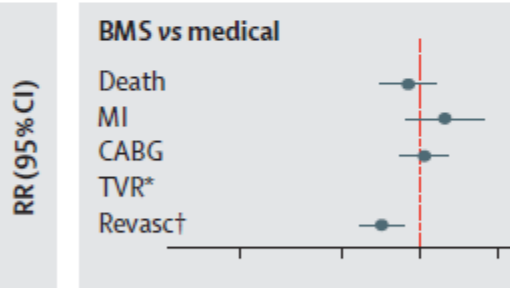


PCI for non-acute IHD: synopsis and network metanalysis

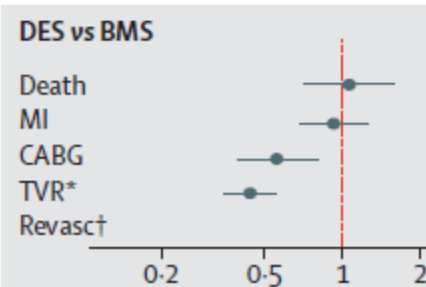
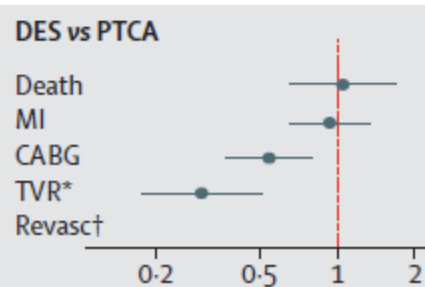
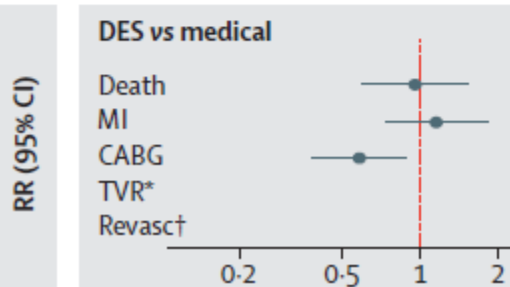
Medical



PTCA

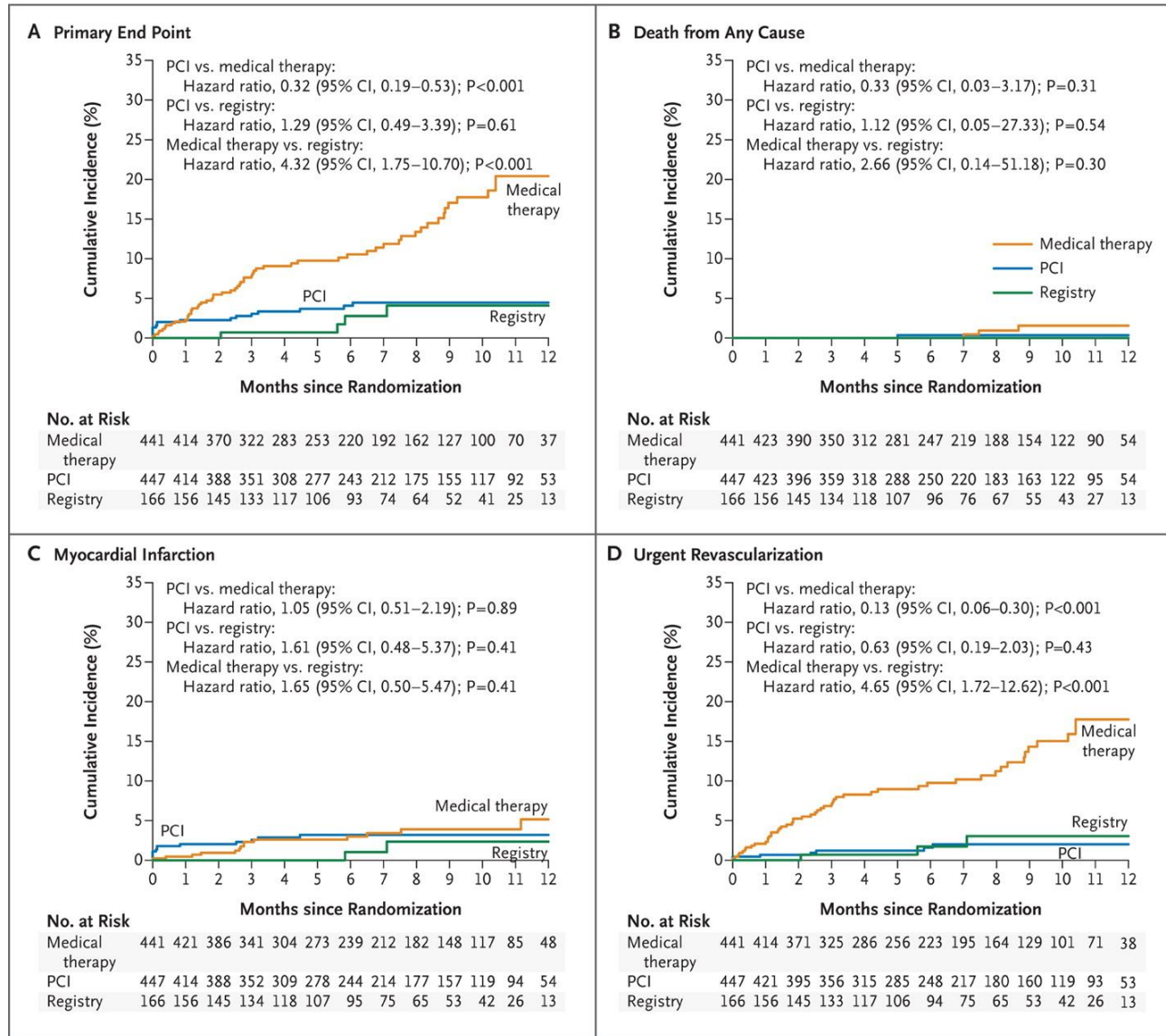


BMS

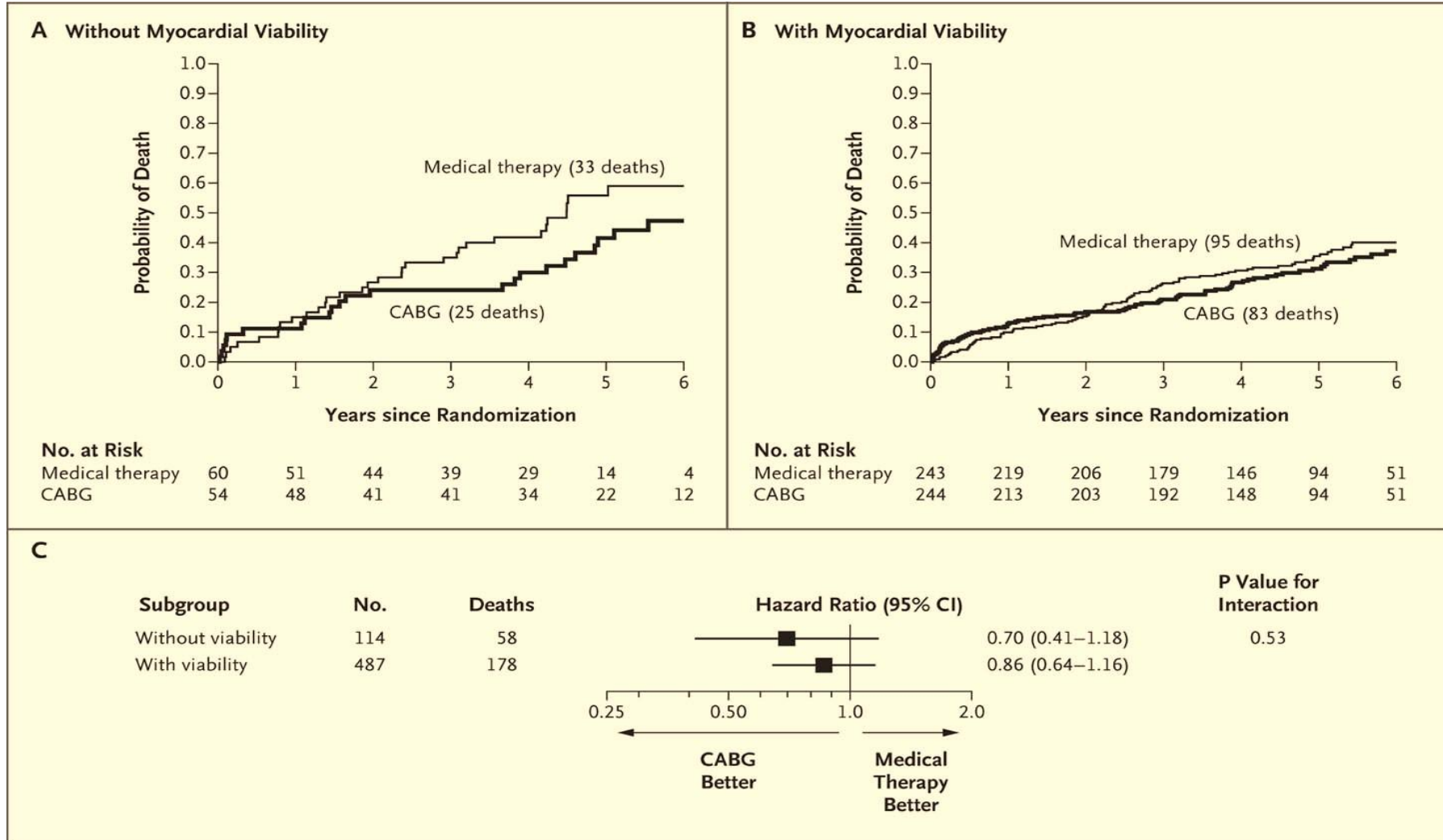


DES

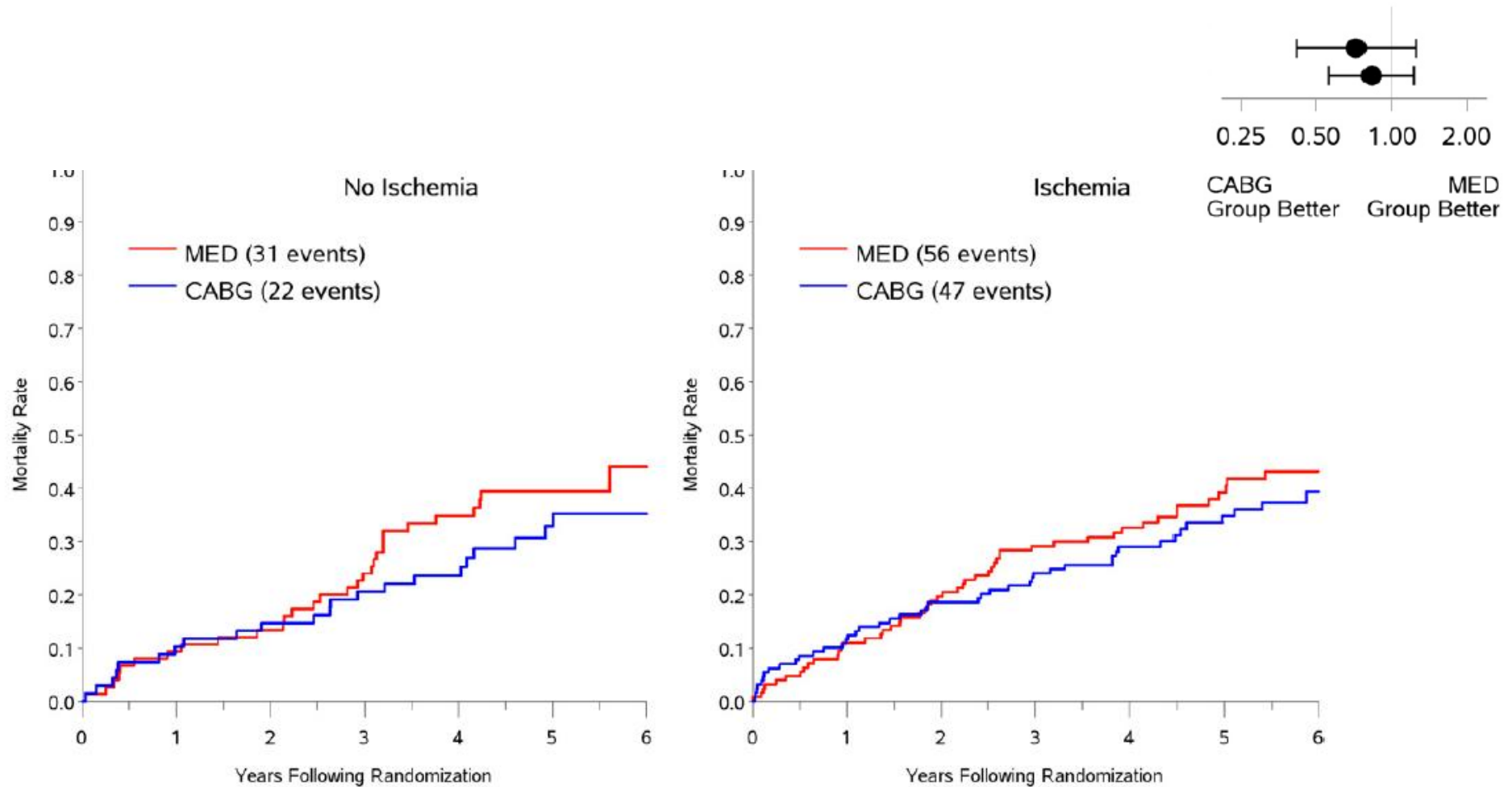
FAME-2 trial



Probability of death according to myocardial viability and treatment



Probability of death according to myocardial ischemia and treatment



Ischemia and prognosis

EDITORIAL COMMENT

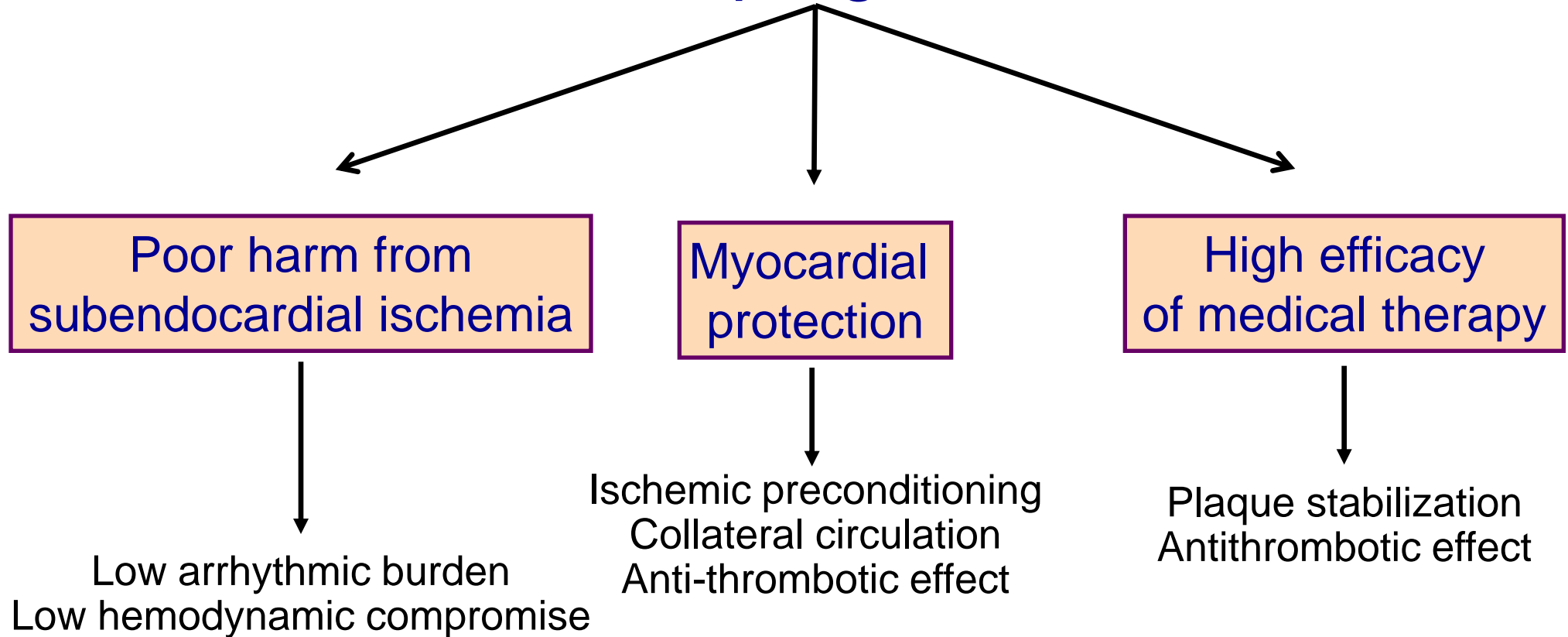
Is Ischemia Dead After STICH?*

Raymond J. Gibbons, MD, Todd D. Miller, MD

Rochester, Minnesota

JACC 2013;61:1871-73

Why MI can show poor relation with prognosis



Conclusions

- ✓ ECG exercise stress test results integrated by clinical findings should be the reference test for risk stratification of patients with suspected or known stable CAD
- ✓ Exercise capacity, which results from a combination of systemic and cardiac (including myocardial ischemia) conditions, is the strongest predictor of prognosis
- ✓ An imaging exercise stress test needs to be added to ECG when the latter is not interpretable and exercise capacity is reduced
- ✓ The exact role of myocardial ischemia (in its various aspects) for risk stratification in the modern era needs to be further addressed and better defined



Thank you !!!